

CHAPTER 7.8 DEQ WATER QUALITY REGIONAL INITIATIVES

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VALLEY REGIONAL OFFICE (VRO)

Shenandoah and Upper James Rivers – Springtime Fish Disease and Mortality.

Springtime fish disease and mortality events have occurred in the Shenandoah and upper James River watersheds since 2004. Relatively high rates of mortality occurred in 2004 and 2005, particularly in the Shenandoah basin. Smallmouth bass and sunfish seem to have been disproportionately impacted, although a number of other species have also been affected, including suckers and catfish. These events have continued each spring, but have been much less severe for the last 4-5 years. During 2013 staff continued to receive occasional reports of fish with skin lesions during spring and early summer. A few reports of small numbers of dead fish were also received. Water quality and fish health investigations by a number of researchers during the 2005-2008 period were unable to identify a single cause for these events, although many of the specimens examined were found to have a condition called furunculosis, caused by a cool-water fish pathogen known as *Aeromonas salmonicida* and characterized by skin and internal lesions. State biologists worked closely with USGS scientists for several years to compare presence of this bacterium on fish before, during, and after fish kill events at multiple sites in the Shenandoah and James River systems. No new research was conducted during 2013; efforts focused primarily on monitoring and tracking outbreaks. This approach will continue in 2014 unless outbreaks occur at severe levels.

South River Mercury.

Mercury was used in a manufacturing process at the DuPont plant in Waynesboro, VA from 1929-1950. Mercury losses and resulting contamination to the river and floodplain from that process resulted in a legacy problem that continues today. In a 1984 settlement between DuPont and the State Water Control Board, a fund was established to support monitoring of water, sediments, and fish tissue in the river system for a projected 100-year period. More recently, in 2006, DEQ established a full-time position in the Valley Regional Office to focus on this serious environmental issue. Specific activities in this program area that occurred during 2012-2013 are outlined below.

- a) **Water Sample Collection and Analysis for Mercury in the South River and South Fork Shenandoah River, Virginia.** This monitoring project focuses on water column concentrations of dissolved and total mercury in the South River and South Fork Shenandoah River. Monitoring through the 1990s rarely detected measurable amounts of mercury in water, due to analytical constraints. With the development of more sensitive techniques ("clean" metals sampling and analyses) during the 1990s, quantifiable levels are now routinely recorded. Since 2001, DEQ staff has collected total and dissolved mercury samples from multiple sites on the South River and South Fork Shenandoah River on a bimonthly frequency.
- b) **South River Science Team.** DEQ staff members continue to coordinate with members of the South River Science Team on a number of surveys and studies in which data are gathered for water, sediments, floodplain soils, and biota in and along the South River. The South River Science team is comprised of representatives from industry, academic institutions, state and federal agencies, environmental groups and independent researchers. This group meets quarterly to coordinate efforts, collaborate on future work, and communicate results. Ongoing studies address mercury source identification, fate and transport, methylation processes, and ecological processes. Information on the activities of the South River Science Team can be found at <http://www.southriverscienceteam.org/>.
- c) **Natural Resources Damage Assessment (NRDA) for South River and South Fork**

Shenandoah River. DEQ is working with other state partners (as the state trustee) and the US Fish & Wildlife Service (as federal trustee) to continue assessment of damages to aquatic and terrestrial life in and along these rivers. Studies by South River Science Team partners and contractors will serve as the basis for damage assessment and will also help identify opportunities for restoration and mitigation. The NRDA team of technical, policy, and legal staff has been meeting several times per year as this process moves forward. Final settlement will address restoration of numerous resources and services, including fish, birds, amphibians, and recreational fishing.

BLUE RIDGE REGIONAL OFFICE – LYNCHBURG (BRRO-L)

Total Maximum Daily Load (TMDL) Studies

There are currently nine (9) TMDL studies being conducted or been completed by BRRO-L water staff. There are currently three (3) Implementation Plans either being conducted or have been completed in BRRO-L over the past two years. The projects are listed in detail below.

Buffalo River

The TMDL study was completed and approved by EPA on 09/20/2013 and the Virginia SWCB on 04/04/2014. The project addressed bacteria impairments in the Buffalo River as well as several tributaries including, Hat Creek, Piney River, Rucker Run, Mill Creek, Rutledge Creek, Turner Creek, and Tye River. A public meeting was held to discuss the TMDL process and the sources of bacteria unique to the Buffalo River basin.

Bent Creek, North Creek, Stonewall Creek, Walkers Ford Creek, and Wreck Island Creek

The TMDL study was completed and approved by EPA on 09/30/2013 and the Virginia SWCB on 04/04/2014. The project addressed bacteria impairments in the Bent Creek, North Creek, Stonewall Creek, Walkers Ford Creek, and Wreck Island Creek. A public meeting was held to discuss the TMDL process and the sources of bacteria unique to these tributaries.

Banister River

The TMDL study was completed and approved by EPA on 07/08/2013 and the Virginia SWCB on 04/04/2014. The project addressed bacteria impairments in the Banister River and Winn Creek. A public meeting was held to discuss the TMDL process and the sources of bacteria unique to the Banister River and Winn Creek.

James River Basin

The TMDL re-development study was started in 2013. The project will address bacteria impairments in the James River as well as several tributaries including, Ivy Cree, Tomahawk Cree, Burton Creek, UT Burton Creek, Judith Creek, Fishing Creek, Blackwater Creek, beaver Creek, Harris Creek, Dreaming Creek, Opossum Cree, Williams Run, Graham Creek, and Pedlar River. A public meeting was held and a public meeting will be held to discuss the TMDL process and the sources of bacteria unique to the James River basin.

Hyco River

The TMDL study was started in 2013. The project addressed bacteria impairments in the Hyco River as well as several tributaries including, Aarons Creek, North Fork Aarons Creek, Big Blue wing Creek, Beech Creek, Little Buffalo Creek, Coleman Creek, and Little Coleman Creek.. A public meeting was held and will be held to discuss the TMDL process and the sources of bacteria unique to the Hyco River.

Buffalo River and Long Branch

The TMDL study was completed and approved by EPA on 11/21/2013 and the Virginia SWCB on Final 2014

03/28/2014.. The project addressed benthic impairments in the Buffalo River and Long Branch. A public meeting was held to discuss the TMDL process and the sources of benthic impairment unique to the Buffalo River and Long Branch.

Phelps Branch

The TMDL study was completed and approved by EPA on 09/30/2013 and the Virginia SWCB on 03/28/2014. The project addressed benthic impairments in Phelps Branch. A public meeting was held to discuss the TMDL process and the sources of benthic Impairment unique to Phelps Branch

Coleman Creek

The TMDL study was started in 2013. The project addressed a benthic impairment in Coleman Creek. A public meeting was held and will be held to discuss the TMDL process and the sources of benthic impairment unique to Coleman Creek

North Creek

North Creek in Fork Union is scheduled for TMDL development by 2014. Biological monitoring at three sites on North Creek has been ongoing since 2007 and a draft TMDL report should be ready by Fall 2014.

James River Watershed Implementation Plan

The project addressed bacteria impairments in the James River Watershed. Tributaries include Ivy Creek, Tomahawk Creek, Burton Creek, Fishing Creek, Blackwater Creek, and Beaver Creek. A public meeting was held to discuss the Implementation Plan process and the sources of bacteria unique to the watershed. The final report was approved by the Virginia SWCB on 06/29/2012.

Lower Banister River Implementation Plan

The project addressed bacteria impairments in the Lower Banister River Watershed. Tributaries include Polecat Creek and Sandy Creek. A public meeting was held to discuss the Implementation Plan process and the sources of bacteria unique to the watershed.

Banister River and Winn Creek Implementation Plan

The project addressed bacteria impairments in Banister River and Winn Creek Watershed. A public meeting was held to discuss the Implementation Plan process and the sources of bacteria unique to the watershed. There will be a final meeting Summer 2014.

Monitoring Initiatives

Targeted Biological Monitoring

Biologists reviewed regional water quality data collected at ambient monitoring stations to identify additional biological monitoring sites. The data were analyzed to identify a range of monitoring stations with respect to nutrients and physical parameters (dissolved oxygen, pH, etc). Higher quality streams are monitored to identify potential reference sites to use in the genus-level Virginia Stream Condition Index development. Lower quality streams are monitored to assess whether the benthic communities are impaired and to identify potential stressors.

Biological Reference Sites

Many reference-quality sites are needed in order to develop a Genus-level SCI. In search of reference sites, previously unmonitored streams are chosen using landuse data and satellite imagery to find the least disturbed watersheds. A variety of stream orders and ecoregions need to be represented in order to develop the best SCI possible, therefore streams are also chosen based on their sizes and locations in an attempt to represent them all sufficiently.

Couches Creek/Kenbridge STP

Biological monitoring on Couches Creek near Victoria will be ongoing in order to determine the effects of

the Victoria West STP on water quality in the stream. This STP periodically exceeds its permit limits for ammonia. Monitoring began in 2008 at two sites on Couches Creek, one site just downstream of the Victoria West STP outfall and the other several miles downstream.

Follow-up on benthic monitoring sites with ambiguous data

Biological monitoring sites that have had assessment judgments withheld due to fluctuating SCI scores or extenuating weather conditions such as droughts and floods are revisited in order to gather additional data and make assessment decisions.

Follow-up monitoring on Cascade Creek

In 2009 a Pollution Response was initiated due to a massive fish kill on Cascade Creek that was caused by illegal dumping of brewer's yeast into the stream. This depleted the dissolved Oxygen in the water and killed numerous fish, including an endangered Roanoke Logperch. Benthic monitoring will continue periodically on Cascade Creek in order to document its long-term recovery. This site was also sampled as a Targeted Stress site in 2012, which enabled additional parameters to be analyzed.

Lawless Creek Superfund Site

Lawless Creek near Chatham, Virginia is located adjacent to the First Piedmont Corporation Rock Quarry Superfund Site. The site was once used as an industrial landfill and consequently has soil and surface water contaminated with metals. A plan for a wetlands remediation project has been proposed by the EPA for a 0.7 acre wetland adjacent to Lawless Creek to remove Zn contaminated wetland soils. A benthic monitoring site was located upstream of the impacted area, however in the fall of 2013 sampling was relocated downstream from the Route 719 bridge in order to document potential impacts from the Superfund Site and from the proposed remediation project. The water at this downstream monitoring site was analyzed for clean metals, in addition to the regular ongoing benthic monitoring.

Environmental Pollution Response

Dan River Coal Ash Spill

On February 2, 2014 a broken stormwater pipe beneath a Duke Energy coal ash retention pond located next to the Dan River near Eden, NC was reported. Approximately 38,000 tons of coal ash spilled into the Dan River. Coal ash contains heavy metals and can be harmful to human health. Monitoring for metals in the water and sediment at eight Dan River sites and two Kerr Reservoir sites began in February 2014 and will continue monthly indefinitely. In addition, two boatable probabilistic sites on the Dan River will be sampled in the spring and fall of 2014 for benthic macroinvertebrates, fish, algae, water chemistry, and habitat quality.

Lynchburg Train Derailment Crude Oil Spill

On April 30, 2014 a train carrying crude oil derailed next to the James River in downtown Lynchburg, releasing 29,916 gallons of crude oil into the river. A fire erupted during the derailment and incinerated an unknown amount of the crude oil, therefore it is unknown exactly how much oil moved downstream. One sample was taken by BRRO-Lynchburg downstream of the spill at Mount Athos Road several hours after the spill, but no other samples will be taken since high river flows at the time of the spill carried most of the product downstream. CSX Transportation has contracted Arcadis U.S. to conduct sampling through July 2014.

BLUE RIDGE REGIONAL OFFICE (BRRO-ROANOKE)

TMDL Activities in the BRRO-Roanoke.

BRRO-Roanoke's TMDL staff assisted in the completion of Implementation Plans on the Lower Blackwater River watershed, Smith and Mayo Rivers, Big Otter watershed, Back Creek, Mill Creek and Dodd Creek. DCR was the lead agency on all of the aforementioned TMDL Implementation Plans except for Back Creek. New River Highlands Resource Conservation and Development Council partnered with Maptech, Inc. to complete the Back Creek Implementation Plan.

BRRO-Roanoke TMDL staff took the lead on the Implementation Plan for the Pigg River watershed and Little River Watershed TMDL and Implementation Plan. DCR, Maptech, Inc. as well as local stakeholders like the Blue Ridge Soil and Water Conservation District assisted with the projects. A watershed tour, agricultural and residential working group meetings, and public meetings encouraged public involvement in the projects. Presentations about the Pigg River Watershed Implementation Plan were given at the Franklin County Cattlemen's Association and the Roanoke River Currents Conference.

BRRO-Roanoke TMDL staff participates in the Stroubles Creek Watershed Initiative (SCWI), which spun off from the Implementation Plan Steering Committee. The SCWI continues to meet as needed to review grant proposals related to the Implementation Plan and participate in various outreach events like Blacksburg's Steppin' Out street festival and Sustainability Week. During Sustainability Week, BRRO-ROANOKE set up a "bug tub" featuring local benthic macroinvertebrates and displays with information about water quality and the Stroubles Creek TMDL. Participants include local residents, Town of Blacksburg, DEQ, DCR, Virginia Tech and leaders in local environmental education initiatives.

BRRO-Roanoke TMDL staff and the DEQ Water Quality Data Liaison coordinated the establishment of Coliscan Easygel monitoring networks in the Big Otter and Looney Creek watersheds. Coliscan sampling and analysis are accomplished in cooperation with the Peaks of Otter Soil and Water Conservation District in the Big Otter watershed and the Mountain Castles Soil and Water Conservation District in the Looney Creek watershed. Collectively, the groups monitored approximately 20 stations.

In 2006, the Montgomery County Public Schools received a Learn and Serve Watershed Grant. DEQ partnered with the school system and participated in two teacher's workshops and a University-Community Partnership Conference. At the workshops, BRRO-Roanoke staff presented information about local water quality monitoring efforts, equipment and TMDLs, while offering support to teachers in the form of technical assistance and equipment. This partnership will continue as new teachers are brought into the program.

Special studies related to TMDLs included water column PCB sampling in the Roanoke River and New River watersheds, diurnal dissolved oxygen studies in the Smith River and Jackson River (Smith River included temperature data), quantitative habitat data collection (using EPA's Relative Bed Stability method) in the Smith River and bacterial source tracking data collection in various watersheds.

BRRO-Roanoke Community Involvement

The BRRO-Roanoke Water Monitoring Group (monitoring, TMDL, and assessment staff) participated in numerous outreach events during 2007-2012. Staff taught area students and teachers about biological monitoring at events such as the Clean Valley Council's Earth Summit, Stream School, Fall Waterways Cleanup, Downtown Learning Center's Summer Enrichment Program, Smith Mountain Lake State Park's Junior Rangers program, Bedford Elementary "Camp Bees" day camp, and Roanoke area Cub Scouts at "Bug Scouts" day camps. The group had displays at the Blacksburg Watershed Open House, Blacksburg's Downtown "Steppin Out" Festival, Mountain Waters Celebration at Lake Moomaw, Philpott Reservoir Environmental Expo, and a Catawba LandCare Organizational meeting informing citizens about TMDLs, water monitoring, and assessments. Staff also made presentations on water pollution, monitoring, and restoration to the following organizations: Friends of Claytor Lake, Franklin County Master Gardeners organization, Roanoke River Currents Conference, Smith River Trout Unlimited Chapter, Southern Rivers Grant Project leaders in Radford, and participated in two teacher's workshops for Montgomery County science teachers. 2008 marked the inaugural year for the Christiansburg High School Environmental Expo. DEQ hosted a booth annually at the event with information about water quality monitoring, biomonitoring and watershed stewardship.

Livability Initiatives

The Livability Initiatives provided multiple forums for residents to discuss housing, transportation, energy, natural resource, economic development, community health, and arts and cultural heritage factors that

affect quality of life now and in the future. BRRO-Roanoke staff participated in Livability Initiative working groups in both the Roanoke and New River Valleys.

LandCare

BRRO-Roanoke staff attended a meeting in the Catawba Valley near Blacksburg Sunday July 22, 2007, sponsored by Catawba LandCare. This group started February 2007, when a small group of neighbors from the Catawba and North Fork Valleys came together to hear about LandCare; what it is, and the concepts behind it. These neighbors came away from that meeting convinced that LandCare should indeed be introduced along the length and breadth of the Catawba Creek and North Fork watersheds including their tributaries. By adopting the LandCare concept, it would enable all stakeholders to take part in the effort to preserve the landscape of Catawba Creek and North Fork Valleys, while at the same time, strengthening its' communities. As a result of that meeting, Catawba LandCare emerged, with the mission of providing education and outreach to the community, encouraging a healthy and sustainable environment in the Catawba Creek and North Fork watersheds, and promoting open space across the Roanoke and Montgomery County boundaries. BRRO-Roanoke TMDL staff set up a DEQ and TMDL display and spoke briefly about DEQ and the TMDL activities in the watersheds. BRRO-Roanoke staff also attended the three day National LandCare Workshop in Blacksburg.

Green Infrastructure

Green infrastructure uses more natural structures and processes to manage water and create healthier urban environments. It can provide habitat, flood protection, cleaner air, and cleaner water. Used on a community or regional scale, green infrastructure is an "interconnected network of land and water that contributes to the health, economic well being and quality of life for communities and people. The project or initiative is designed to bring together diverse organizations and agencies involved in resource protection, economic development, infrastructure, heritage, recreation, and land management. The initiative is growing in the New River Valley and BRRO-Roanoke staff are active as part of the Advisory Committee.

Girl Scouts

BRRO-Roanoke Water Permitting, Waste and TMDL staff partnered with the Western Virginia Water Authority and worked with local Girl Scout troops to educate them about environmental issues. The girls learned about aquatic insects, water quality monitoring, watersheds and landfills. They collected water quality data including pH, dissolved oxygen, and turbidity from Carvins Cove Reservoir. Troops also toured the water treatment plant in Roanoke. The WVWA and DEQ have partnered to put together this event for two years in a row and hope to make the workshop an annual event.

William Byrd High School

In spring 2008, BRRO-Roanoke staff taught students and teachers in the Learn and Serve program's Biology class about stream ecology and water quality monitoring during a field trip to Wolf Creek including hands-on biological monitoring and stream habitat assessments. Through this partnership, BRRO-Roanoke staff coordinated the McDonald's Mill Outdoor Watershed Education Lab on the North Fork of the Roanoke River in fall 2008. Approximately 70 Ecology students and teachers learned about water monitoring through hands-on chemical and biological sampling with VDEQ staff and Virginia Save our Streams and Clean Valley Council volunteers. A stream restoration and riparian buffer tour was conducted by VDGIF biologists and an introduction to conservation easements and preservation of land to benefit wildlife and water quality was provided by Catawba LandCare staff and the Mill's landowner. The success of the event has led to the invitation to all area high schools to use this farm and Virginia Tech's Catawba Farm for future hands-on experience in an outdoor classroom setting.

Jackson River Restoration and the Gathright Dam Water Control Plan

The Virginia Department of Environmental Quality's (DEQ) monitoring and assessment data and Jackson River benthic Total Maximum Daily Load (TMDL) development (DEQ 2010) has documented that low flow conditions in the fall represent the most stressed water quality conditions in the Jackson River. The Jackson River benthic TMDL study established nitrogen and phosphorous reduction targets in the Jackson River and called for restoring natural flow variability during the growing season (defined in the TMDL study as June 1st to October 31st). To assess flow variability impacts on water quality habitat and biology, DEQ asked the U.S. Army Corps of Engineers (ACE) to perform a 216 study that could result in permanent flow modifications in the Jackson River. The 216 Study was later changed to the Gathright Dam Water Control Plan. As part of the study and later the plan, the ACE performed test pulses during the following dates: August 17, 2010, September 28, 2011, and October 3, 2012. In 2010 thru 2012, DEQ collected an extensive suite of field data, water chemistry, habitat, and biological parameters in order to document baseline conditions and evaluate effects of the test pulses. DEQ is committed to extensive water quality monitoring in the Jackson River throughout the development of the Water Control Plan project and during the implementation of the recommended hydrologic changes. DEQ published the following reports which summarize existing water quality conditions and document results of the pulse events: *Characterization of 2010 Base Flow and Pulse Flow Water Quality in the Jackson River* and *Characterization of Jackson River Base Flow and Pulse Flow Water Quality: 2011 and 2012*. DEQ continues to monitor and evaluate water quality on the Jackson River.

PCB Source Investigations in the New River VDH Fish Consumption Advisory Area

From 2002 – 2004, an intense search for PCB sources was conducted in the New River watershed from Claytor Lake Dam to the Virginia-West Virginia State line near Glen Lyn. The investigation involved extensive review of VA DEQ agency records, interviews of local officials, citizens, industry representatives, and information provided by the New River PCB Source Study Citizen's Committee. Based on these interviews and follow-up onsite inspections, DEQ teams sampled soil and sediment from multiple areas in the New River Valley in the fall of 2003. The investigation incorporated approximately 50 sites of sediment and soil samples. DEQ initiated additional source investigation and pre-TMDL PCB monitoring in 2010 and continues to collect fish tissue, sediment and water column PCB data.

James River Fishkill Monitoring

During the spring and summer periods of 2007 – 2009, BRRO-Roanoke staff has assisted with the investigation of fishkills of unknown causes in the upper James River system. Predominantly smallmouth bass and sunfish are the affected species and have been observed with skin lesions and other health problems during the spring and early summer. During 2007 staff monitored and confirmed citizen reports of distressed and dead fish in the James River, monitored environmental conditions and assisted VDGIF biologists with fish collection for health analyses by USGS and university scientists. In 2008, staff continued to track citizen reports and collected multiple parameters (physical/environmental conditions, metals, organics, nutrients, and pesticides) on the James River and a reference site on the New River, as well as assisted with the collection of fish during pre-kill, within kill, and post-kill periods on both rivers. During spring and summer 2009, staff collected weekly bacteria samples for *Aeromonas salmonicida* at ten stations on the upper James River and several tributaries. Staff also assisted with fish collection on the James River and tributaries and deployed temperature loggers at multiple locations to monitor daily water temperatures. Collection of bacteria samples, monitoring of water temperatures, collection of fish and tracking citizen reports is to be continued in 2010.

Mudlick Creek Stream Restoration Project

BRRO-Roanoke water monitoring and VWP staff assisted Roanoke County with a stream restoration project at Garst Mill Park from 2007 to 2009. Pre-restoration activity included monitoring the benthic macroinvertebrate community, monitoring turbidity during storm events, and measuring stream bank erosion in several sections of Mudlick Creek. Staff also provided technical guidance with restoration

design plans for County officials, DCR staff, and consultants that produced the design and supervised the project. Staff attended informational meetings held at the park to inform citizens of the project and its benefits to water quality. Post-restoration monitoring will include assisting the county with biological monitoring bank erosion surveys.

SOUTHWEST REGIONAL OFFICE (SWRO)

Exeter WWTP

The Town of Appalachia is providing public wastewater collection and treatment to the Exeter area of Wise County. Exeter is located near the Wise/Lee county line along Route 68 between Appalachia and Keokee.

Exeter was originally a residential coal camp formed around 1917 by the Stonega Coal and Coke Company. Today it is still a residential community and has a population of approximately 300 people living in 125 households. The community is situated in a narrow valley and is drained by Pigeon Creek. Lot sizes are small, and housing density is high, considering the available land for housing.

There was no public wastewater collection or treatment infrastructure in the Exeter community. Residents relied on makeshift septic tank/drainfield installations (installed prior to regulations governing septic systems) or straight pipe discharges to Pigeon Creek. In some cases, domestic wastewater discharges to septic systems while gray water is piped straight to the creek. Most of the septic systems had limited or no drainfield capacity due to the small lot sizes. The Exeter wastewater collection and treatment project eliminated failing private systems and illegal discharges, and provided a cost-effective solution to providing public sewer service.

Nora WWTP

DEQ is processing wastewater discharge permits for the Dickenson County Public Service Authority to provide sewerage service to the small community of Nora. There are 13 homes and a convenience store located along the McClure River. This is an older community, established to provide housing for coal miners in the early to mid 1900s, many having straight pipe discharges (with no wastewater treatment) to the McClure River. The total cost of the project is \$475,000, and is being funded by the County and the Department of Mines, Minerals, and Energy (DMME). A portion of the County funding is for mitigation for stream and wetland impacts resulting from a school consolidation project that was also permitted by DEQ under the Virginia Water Protection Program. The DMME is allocating \$130,000 from monies collected for water permit violations from coal mining operations. McClure River is impaired for excess bacteria, and this project will greatly improve water quality in the River.

NORTHERN REGIONAL OFFICE (NRO)

Biological Monitoring:

Genus-level Benthic Macroinvertebrate Identification Certification

In March 2012, NRO biologists, along with regional biologists across the state, took and passed the Society for Freshwater Science exam for Ephemeroptera, Plecoptera, and Trichoptera (EPT) benthic macroinvertebrate genus-level identification certification. Recertification will be required every 5 years.

Probabilistic Biomonitoring and Chemical Monitoring Program in Virginia Non-Tidal Streams

NRO has participated in DEQ's Probabilistic Monitoring Program since its inception in the spring of 2000. This program consists of three sampling components: a thorough examination of the benthic

macroinvertebrate community utilizing the EPA's Rapid Bioassessment Protocols, sampling a full suite of water chemical parameters, and a physical habitat evaluation at each station. The stations are biologically and chemically sampled twice a year, once each in the spring and fall, while a single, extensive, physical habitat evaluation is conducted in the fall. In 2011, NRO sampled 10 probabilistic stations, 8 in the spring and 9 in the fall (2 were single, boatable samples). Eight probabilistic stations were sampled in calendar year 2012, 6 in the spring and 8 in the fall (2 were single, boatable stations).

Citizen Requested and Follow-up to Citizen Volunteer Biological Monitoring

Citizen monitoring stations, where water quality degradation was indicated in the 2008 Integrated Assessment, were prioritized for follow-up monitoring. Based on review of the data, 1 biological monitoring station was collected by NRO in 2011. These data, in conjunction with the citizen data, will be used to assess the stream segments initially identified by non-agency sampling.

In 2011, citizens of Virginia requested that 4 stations be biologically monitored by NRO. Similarly, 4 stations were also requested by citizens in 2012.

All of the locations mentioned in this section were sampled twice in one year, once each in the spring and the fall.

Genus Virginia Stream Condition Index (VSCI) and Coastal Plain Macroinvertebrate Index (CPMI) Development Sampling

NRO has been involved in the development of a genus-level VSCI since 2010. Eleven excellent-condition streams were biologically and chemically sampled from 2010 through 2012.

Since 2009, NRO has also been participating in the development of both a family-level and a genus-level benthic macroinvertebrate index to refine the assessment of Coastal Plain and Southeastern Plains, defined-channel streams. Thirteen stations, including both excellent-condition and stressed-condition streams, have been biologically and chemically sampled since 2009 by NRO.

Special Studies:

Special Study and Citizen Requested Monitoring

In 2011 and 2012, NRO collected special study ambient monitoring data for the following streams: Camp Creek, Wheeler Creek and Limestone Creek. In addition, ambient data was also collected in 2011 and 2012 to honor the requests of citizens in the Little Pimmit Run watershed.

Hardness Study Monitoring

In 2011 and 2012, NRO also participated in a hardness study for Polecat Creek. This study involved collecting clean metals samples in Polecat Creek above and below the Caroline Regional WWTP discharge, as well as at the facility discharge. The facility was artificially raising their hardness of their effluent and this study was undertaken to determine if this practice was impacting the water quality of the stream.

Harmful Algal Bloom (HAB) Monitoring

NRO collected ambient and algae data at 10 stations in 2011 due to concern that blooms may have involved harmful algae. There was a HAB event in Aquia Creek in July and August of 2011, and during this time, NRO collected 19 ambient and HAB samples at seven different locations.

Total Maximum Daily Load Monitoring:

In 2011 and 2012 the Northern Region of DEQ devoted a significant amount of their monitoring efforts to collecting data for the Total Maximum Daily Load (TMDL) Program. Monitoring was conducted for the

purpose of TMDL development, TMDL Implementation Plan follow-up, and Natural Condition Report development.

TMDL Development

Monitoring to support bacteria TMDL development in the Mattaponi River Basin was conducted on the following streams in 2012: Brock Run, Po River, Polecat Creek, Mattaponi River, Matta River, Poni River, and Po River.

Ambient sampling and base flow/storm flow event sampling, including clean metal collection, was conducted in Holmes Run and Tripps Run in 2011 and 2012 in support of the development of benthic TMDLs.

In 2011, ambient sampling was conducted on both the South and North Forks of Catoctin Creek to support the development of benthic TMDLs for these streams. The sampling on the North Fork of Catoctin Creek continued in 2012. Additionally, in 2011, biological sampling was performed at 7 stations in both the North and South Forks of Catoctin Creek in support of benthic TMDL development. The number of stations dropped to 1 in the North Fork and 4 in the South Fork in 2012.

NRO collected ambient monitoring data in 2012 for upcoming benthic and bacteria TMDL development for the Broad Run watershed which included the following streams: Broad Run, Beaverdam Run, and South Fork Broad Run. Monitoring efforts included collection of clean metals during storm event sampling and base flow sampling at one station on Broad Run. Additionally, benthic macroinvertebrates were collected from 2 stations along Broad Run in Loudoun County. Continuous monitoring data was also collected at selected sites on Broad Run.

Ambient monitoring data was collected for the following waterbodies in 2012 in support of the upcoming bacteria TMDLs for the Tidal Occoquan and tributaries to the Occoquan Reservoir projects: Sandy Run, Wolf Run, Mills Branch, Occoquan River, Hoes Run, and Marumsco Creek.

NRO has been sampling sites with acceptable biological conditions that are collocated with flow gages since 2010 on a rotating basis, with the goal of providing watershed information for future TMDL development projects.

Implementation Plan Follow-Up Monitoring

In 2011 and 2012, NRO collected ambient monitoring data for as follow-up to the implementation plans developed for the following streams: Thumb Run (includes the East and West Branches), Carter Run, Great Run, Deep Run, Marsh Run, Brown Run, Craig Run and Robinson River.

Natural Condition Report Development

In 2011, NRO collected ambient monitoring data for upcoming Natural Conditions Report development for the following streams: Gingoteague Creek, Goldenvale Creek, Chapel Creek, Beverly Run, Doctors Creek, and Root Swamp.

Total Maximum Daily Load Studies:

In 2011 and 2012, NRO continued work on the development of two bacteria TMDL reports covering 12 impaired segments. The Sugarland Run, Mine Run, and Pimmit Run Bacteria TMDL involved watersheds located in Loudoun, Fairfax, and Arlington Counties. The Tributaries to the Potomac River: Prince William and Stafford Counties Bacteria TMDL incorporated the following watersheds: Powells Creek, Quantico Creek, South Fork Quantico Creek, North Branch Chopawamsic Creek, Austin Run, Unnamed Tributary to the Potomac River, Accokeek Creek, Potomac Creek, and Potomac Run. Both of these TMDL reports were approved by EPA in 2013.

Post Implementation Plan Projects:

In the NRO region, there have been two TMDL Implementation projects underway that have involved citizen water quality monitoring: the Carter Run, Thumb Run, Deep Run, and Great Run in the Upper Rappahannock Watershed and the Upper York: Terry's Run and Pamunkey Creek in the Upper York Watershed. The purpose of this has been to develop a better idea about the specific locations of bacteria runoff in the watershed (hotspot monitoring) and also to evaluate the effectiveness of various Best Management Practices as they are installed (pre/post-BMP monitoring). Funding for this targeted monitoring is generally provided through the EPA Clean Water Act Section 319 funds, but also in some cases with Watershed Roundtable funds, SWCD operational funds and other DEQ funding sources. Both citizen groups and SWCD staff have provided assistance through coliscan testing for *E. coli* bacteria. Carter Run, Thumb Run, Deep Run and Great Run TMDL Implementation Project

In this project, led by the John Marshall Soil and Water Conservation District (JMSWCD), there were both hotspot and pre/post-BMP monitoring during the 2011-2012 period. The hotspot monitoring sites for bacteria included 1 site for Carter Run, 10 sites for Thumb Run, 9 sites for Great Run and 1 site for Deep Run. Reportedly, most of the projects in the area have been driven more by farmer interest as opposed to hotspot data, but as improvements are evaluated in the watershed, the SWCD's additional bacteria data may be helpful in documenting success in meeting water quality standards. In the Carter Run watershed, SWCD staff also used "coliscan easygel" before, during and after the fencing of a Carter Run tributary and a large pond that drains into the tributary. One sampling location was just below the fencing project and the other was in the pond itself. Data showed that the stream improved remarkably from 1025 cfu/100 ml in December 2010 to 0 cfu/100 ml in August 2012 with slight levels after rain events of 25-50 cfu/10 ml since then. The pond showed less improvement, possibly due to large numbers of Canada geese that frequent the pond's mowed edge. It is noted that Carter Run has been recognized for an EPA Nonpoint Source Program Success Story in Virginia due to the approximately 143 BMPs, both agricultural (stream exclusions, permanent vegetative cover on cropland and riparian forest buffers) and residential (septic system pump outs, repairs and replacements), that have been installed through 2012. The work of JMSWCD and partners has resulted in notable reductions in bacteria loadings in this watershed, and the water quality data collected at a long-term monitoring station shows a significant decline in *E. coli* violations. The Deep Run watershed also had a hotspot coliscan sampling site, and 1 pre/post-BMP monitoring location related to stream exclusion and buffer improvements made at a hog farm. Data is still being collected from that location.

Upper York TMDL Implementation Project

The Upper York Implementation project focused on Terry's Run and Pamunkey Creek. Both the Lake Anna Civic Association (LACA) and the Culpeper SWCD (CSWCD) have been integral in carrying out the bacterial monitoring plan for the Pamunkey Creek and Terry's Run watersheds in Orange County, VA, which has been partially funded through the EPA Section 319 funding and York Roundtable funding. The CSWCD has been leading the installation of agricultural and residential BMPs in these watersheds. The LACA water quality monitoring program volunteers have assisted with the hotspot and pre/post-BMP monitoring related to this project since April 2012. For the hotspot monitoring, LACA collected bacteria samples from 9 sites in the Pamunkey watershed and 7 locations in Terry's Run watershed from April 2012 to March 2013. They also produced informative maps and spreadsheets to display the collected data. These hotspot assessments have aided the CSWCD in the focus of their agricultural and residential BMP cost-share implementation related to this project. LACA also completed pre-BMP monitoring at a farm in the Pamunkey watershed and CSWCD completed pre-BMP monitoring on farms in both watersheds: one site is near the headwaters of Terry's Run and the other is downstream closer to Lake Anna on Pamunkey Creek. Both groups recently began their post-BMP monitoring as the stream exclusion practices were not completed until the end of 2013. With the high level of stream exclusion and septic practices being installed in the Upper York watershed, improvements in water quality are expected in the near future.

PIEDMONT REGIONAL OFFICE (PRO)

Atmospheric Deposition of Mercury at Harcum, VA 2004-2007

In response to concerns relating to the 2003 Virginia Department of Health (VDH) fish consumption advisory for mercury in the Dragon Run/Dragon Swamp/Piankatank River watershed, the DEQ Piedmont Regional Office entered into a collaborative effort with Dr. William Reay of the Virginia Institute of Marine Science (VIMS) and the DEQ Coastal Zone Management Program to establish and maintain a National Atmospheric Mercury Deposition Network (MDN) station to monitor weekly inputs and loadings of mercury into the watershed. The station was constructed on Dr. Reay's property in Harcum, VA and he maintained it and performed the weekly monitoring tasks. This summary covers from December 2004 through June 2007. Oversight of the station was transferred to Central Office Air Monitoring in 2008.

Dr. Reay collected ninety-four (94) weekly samples of rainfall at the Harcum station during this study. There were 25 other weeks in the period where there was no precipitation to sample. A MDN laboratory in Illinois analyzed the samples for total mercury (Hg). The mean Hg concentration for the period was 9.1 ng/l and the mean deposition load, which combines rainfall with Hg concentration, was 185 ng/m². The concentrations and loads varied widely from a minimum concentration of 0.92 ng/L and load of 3.91 ng/m² to a maximum concentration of 40.4 ng/L and load of 1697 ng/m². There appeared to be a pattern of seasonality in the Harcum data; monthly totals generally showed highest deposition loads in the summer and lowest loads in the winter. This pattern also appeared in the other two station datasets from Virginia, which are located in Culpeper and in Shenandoah National Park. Harcum data was also compared with data from stations in Acadia National Park in Maine and Everglades National Park in Florida. The lowest Hg concentrations and loads generally appeared in the upper Northeastern USA as evidenced by mean Hg at Acadia, ME of 6.8 ng/L. Mid-Atlantic concentrations and loads were mid-range as shown by Harcum at 9.1 ng/L. The far Southeastern USA had the highest concentrations and loads, reflected by the Everglades mean mercury concentration of 14.1 ng/L.

The Harcum, VA station VA98 mercury dataset may be found at <http://nadp.sws.uiuc.edu/sites/siteinfo.asp?id=VA98&net=MDN>. The study summary may be obtained from Mark Alling of Virginia DEQ by emailing Mark.Alling@deq.virginia.gov.

Harmful Algal Bloom Response and Monitoring Program

The DEQ investigates fish kills to determine whether they are caused by algal blooms, and, if so, to determine whether harmful algal blooms (HAB) are present. Many fish kills are juvenile menhaden kills which are typically attributed to low dissolved oxygen and stranding overnight at low tide. In most instances no lesions are observed on these fish, HAB counts are low, and DNA probe results are negative. However, fish kills are often caused by both toxic and non-toxic algal blooms. In its early stages, the blooms elevate dissolved oxygen (DO) and pH but, as the bloom dies, DO can drop to hypoxic levels resulting in fish and crab kills. In addition, some HAB species can cause lesions on fish and have been tied to health effects in fisherman.

During HAB investigations, DEQ collects dissolved oxygen, pH, temperature, and a full range of water quality analyses - including dissolved, particulate and total phosphorus and nitrogen, chlorophyll a, biochemical oxygen demand, total suspended solids, and total organic carbon. Algae samples are collected by the DEQ and are sent to Old Dominion University for identification and HAB algal cell counts, and are sent to the Virginia Institute of Marine Science (VIMS) for DNA probe identification.

Specific Investigations:

2007

A *Karlodinium* dinoflagellate HAB in the Potomac River lasted approximately 8 weeks during June through August 2007. At its peak, the bloom extended from Upper Machodoc Creek, which is located upstream of Colonial Beach, down to Sandy Point, which is 30 miles below Colonial Beach. Locations of the densest areas of the bloom varied up and down the river, but most often occurred from the municipal

pier in Colonial Beach to below the mouth of Mattox Creek. In later stages of the bloom, it also entered Monroe Bay behind Colonial Beach. On July 11, the bloom resulted in a major fish kill of 300,000 menhaden, white perch, croaker, and other species in Mattox Creek.

2008

An algae bloom occurred on Mattox Creek in Westmoreland County on 7/28/2008, with dissolved oxygen (DO) supersaturation of 179% and total phosphorus of 0.17 mg/l. No dead fish were observed. A fish kill of many juvenile menhaden occurred in the headwaters of Horn Harbor, possibly due to low DO stranding.

A very large microcystis HAB occurred on the Potomac River from Mattawoman Creek downstream 15 miles to Fairview Beach on 8/8-13/2008, with up to 1.1 million cells/ml and microcystin toxin up to 247 µg/l. The recommended EPA microtoxin water quality criterion is 10 µg/l.

2009

A Colonial Beach/Potomac River fish kill of croaker, perch, and menhaden was reported by VIMS on July 1, 2009. PRO counted 118 gizzard shad, white perch, catfish, striped bass, American eels and one blue crab. No HAB was visible although pH was elevated to pH 8.5 SU.

On August 20, 2009, a large fish kill of juvenile menhaden occurred at the New Point Comfort Camp Marina. The fish kill was estimated to be from 500,000 – 1 million fish and was caused by low DO stranding.

2010

Harmful algal blooms and juvenile menhaden fish kills were most widespread and frequent in 2010. On May 5, 2010, a bloom of *Karlodinium* dinoflagellate occurred in the Ware and East Rivers, tributaries of Mobjack Bay in Gloucester and Mathews Counties, respectively, in the 100,000 cells/mL range. On May 6, 2010, a bloom of *Polykrikos* occurred elsewhere in the Ware River, a tributary of Mobjack Bay in Gloucester County, in the 8,000 cells/mL range.

Aimes Creek, a tributary of Lower Machodoc Creek in Westmoreland County, experienced a *Karlodinium* dinoflagellate bloom on May 21, 2010 in the 8,000 – 10,000 cells/mL range.

On June 28, 2010, a bloom of *Akashiwo* and *Heterocapsa* occurred in the York River at Gloucester Point in Gloucester County. Cell counts were unavailable.

On July 3-5, 2010, a fish kill of juvenile menhaden of approximately 250,000 fish occurred in Barn Creek, a tributary of Milford Haven in Mathews County. The water color was very green and dissolved oxygen (DO) was 0.09 mg/L. Some oysters were also killed. The algal species were not available. A second fish kill of several hundred to 1000 adult menhaden occurred on Barn Creek on August 28, 2010. The Virginia Marine Police examined the site and concluded that the cause was probably due to high temperatures, low DO and shallow waters. No algal bloom was observed. A third juvenile menhaden fish kill of 100 juvenile menhaden per square meter occurred in again in Barn Creek on September 14, 2010. The DO was measured at 18.3 mg/L (224% saturation) with a *Chattonella* bloom of 520 cells/mL and chlorophyll-a of 338 µg/L present.

On July 15, 2010 a bloom of *Gymnodinium* and *Cryptomonas* dinoflagellates occurred in Hampton Hall Creek, a tributary of the West Branch of the Yeocomico River, in the 640 cells/mL range.

On July 26, 2010 a bloom of *Cochlodinium* dinoflagellate, which can be toxic, occurred in Sarah Creek and the lower York River. Cell counts were unavailable. This bloom grew into the lower James River and lower Chesapeake Bay until at least August 11, 2010. Some dead croakers were observed near the Chesapeake Bay Bridge Tunnel.

On August 2, 2010, a fish kill of thousands of juvenile menhaden occurred in Oyster Creek, a tributary of the Rappahannock River in Lancaster County. The fish kill was caused by low DO stranding in shallow

water. An algal bloom was not observed.

On August 10, 2010 a large fish kill of juvenile menhaden occurred on Cobbs Creek, a tributary of the Piankatank River in Mathews County. An algal bloom of the raphidophyte *Chattonella* and low DO in the 2.6 mg/L range accompanied the fish kill. Another fish kill of approximately 174,000 juvenile menhaden occurred in this creek on August 16, accompanied by a *Chattonella* and *Gymnodinium* bloom with the algal biomass chlorophyll-a of 133 µg/L (bloom > 50 µg/L), and supersaturated DO of 12.8 mg/l due to the bloom photosynthesis. A third fish kill of more than 6,000 estimated juvenile menhaden occurred on Cobbs Creek on August 27-28, 2010. The DO was 0.8 mg/L and no algal bloom was noted. A fourth fish kill of thousands of juvenile menhaden occurred on Cobbs Creek on September 14, 2010.

On August 12, 2010, a bloom of an unknown algae turned the water color green on the tidal Pamunkey River in Hanover County. Taxonomic identification and cell counts were unavailable.

On August 31, 2010, a bloom of an unknown algae with an algal biomass chlorophyll-a of 70.5 µg/L (bloom > 50 µg/L) and 134% supersaturated DO occurred on tidal Owens Pond in Northumberland County. No fish kill was observed.

On September 4, 2010 a large fish kill of up to 10,000 juvenile menhaden occurred in Queens Creek in Gloucester County. The cause was probably due to high temperatures, low DO and shallow waters. No algal bloom was observed.

Also on September 4, 2010, a large fish kill of juvenile menhaden occurred in Antipoin Creek in Lancaster County. The cause was probably due to high temperatures, low DO and shallow water. No algal bloom was observed. A second juvenile menhaden fish kill of greater than 150,000 fish occurred in Antipoin Creek on September 8, 2010. This time the DO was measured at 0.8 mg/L and a *Chattonella* bloom >1000 cells/mL with chlorophyll-a of 256 µg/L (bloom > 50 µg/L) was present. *Chattonella* at this concentration may produce a brevetoxin which can cause neurotoxic shellfish poisoning (NSP). A third juvenile menhaden fish kill occurred in Antipoin Creek on September 14, 2010. This time the DO was measured at 1.3 mg/L with chlorophyll-a of 119 µg/L present.

In early September 2010 an algal bloom of cyanophytes *Oscillatoria* and *Aphanizomenon* occurred in the tidal freshwater Appomattox River near the municipal water intake for Hopewell, VA. These blue-green algae are known to cause taste and odor problems in drinking water, which occurred at the time.

On September 13, 2010 a large fish kill of thousands of juvenile menhaden occurred in Dancing Creek, a tributary of the Piankatank River in Gloucester County. The cause was probably due to high temperatures, low DO and shallow water. No algal bloom was reported.

On September 26, 2010 a large fish kill of a thousand juvenile menhaden occurred in Wilton Creek, a tributary of the Piankatank River in Gloucester County. The cause was probably due to high temperatures, low DO and shallow waters. No algal bloom was reported.

2011

On March 4, 2011, a bloom of the dinoflagellate *Heterocapsa* reached 27,750 cells/mL in tidal Totuskey Creek in Richmond County at the Rt. 3 bridge. The bloom senesced by March 7, 2011.

In late May 2011, an algal bloom was observed and sampled on the Rappahannock River at rivermile 21.36. The dinoflagellates *Heterocapsa*, *Gyrodinium*, *Prorocentrum* and *Karlodinium* were abundant in the sample. Cell counts were not available.

On July 7, 2011, a small fish kill (no more than 50, species unknown) occurred in Byrd Park Lake in the City of Richmond. The water temperature was 32°C, pH 9.5 S.U., DO 10.5 mg/L (144% saturation) with a very green color, which indicated that an algal bloom was occurring.

On July 8, 2011, a fish kill of >100 juvenile menhaden occurred in Put In Creek, a tributary of the East

River in Mathews County. The cause was probably due to high temperatures, low DO and shallow water. No harmful algal bloom species were reported.

On July 20, 2011, a fish kill in a private pond below a poultry processing plant in Hanover County killed 3,436 juvenile largemouth bass and 1,747 juvenile *Lepomis* (sunfish), due to high water temperature (36.7°C), high pH (9.8), both of which were water quality standard violations, and high DO of 19.3 mg/L (289% saturation) from a *Microcystis* HAB. Biochemical oxygen demand (BOD5) was 12 mg/L and chlorophyll-a was 187 µg/L. Since 2005, the poultry processing facility has removed much phosphorus from the plant effluent, but nutrients cycling in the pond from legacy high nitrogen and phosphorus discharges allowed a blue-green algae bloom to become dense, causing capture of heat from sunlight and high pH from photosynthesis. On October 6, 2011, a second fish kill in the same private pond resulted in 1,748 dead *Lepomis*, 100 largemouth bass, 7 crappie and 13 channel catfish.

On July 21, 2011 a dinoflagellate bloom of *Gyrodinium*, *Prorocentrum*, *Gymnodinium*, *Chattonella*, *Karlodinium* and *Scrippsiella* at 4,670 cells/mL occurred in the Potomac River from Colonial Beach, VA, downstream to Westmoreland State Park in Westmoreland County. No dead fish were observed.

2012

PRO investigated a fish kill of approximately 500 adult menhaden in an unnamed cove of Antipoin Creek on 7/3/2012. At low tide, there was no water channel downstream to open water. The temperature was 33.5°C, pH 7.95 S.U., DO 12 mg/L (170% saturation) and the water color was green. This event was possibly a net dump because adult menhaden are not expected to become trapped in a DO stranding situation like juveniles. A fish processing facility is close downstream.

On August 13, 2012, a small fish kill of flounder, sole, pipefish and a few crabs occurred on the Rappahannock River 2 -3 miles downstream of the Rt. 3 bridge along the south shoreline. The water temperature was 30.2°C, pH 8.31 S.U., DO 12.52 mg/L (166% saturation), which indicated the presence of an algal bloom. Algal identification was not available.

James River PCB Water Column Study

Due to the presence of PCBs, the VDH has issued a fish consumption advisory for the James River from the I-95 Bridge in Richmond downstream to the Hampton Roads Bridge Tunnel and the tidal portion of the following tributaries: Appomattox River up to Lake Chesdin Dam, Bailey Creek up to Rt. 630, Poythress Run, Bailey Bay, and the Chickahominy River up to Walkers Dam. The advisory recommends that adults do not eat gizzard shad, carp, or blue- and flathead catfish >32 inches long. It also recommends that adults eat no more than two meals/month of blue and flathead catfish <32 inches long, channel catfish, white catfish, largemouth bass, bluegill sunfish, American eel, quillback carpsucker, smallmouth bass, creek chub, yellow bullhead catfish, white perch, striped bass, bluefish, croaker, spot, blueback herring, and hickory shad.

In preparation for the 2014 James River PCB TMDL, DEQ initiated a study of PCBs in ambient water in the James River using a high resolution/low detection method (EPA Method 1668A). During mid-to late 2011, one-time samples were collected at four stations between Hopewell and the Chickahominy River. In addition, monthly samples were collected at the James River near Jordan Point (Rt. 156 bridge station (2-JMS074.44)). The data will be used to support development of a model for the James River TMDL.

Mercury Water Column Studies in the Chickahominy, Pamunkey, Mattaponi, and Rappahannock Rivers in 2012

The Virginia Department of Health (VDH) issued a Fish Consumption Advisory for Chickahominy Lake on 7/20/2006. This advisory was established after unacceptable levels of mercury (Hg) in fish tissue of Largemouth Bass, Chain Pickerel and Bowfin were detected. This one year study was designed to begin

gathering data to determine the spatial extent of this mercury problem in the watershed and to observe patterns of relative contamination throughout the watershed. Monthly monitoring of trace total Hg in water was performed in 2012 at 11 stations. The chronic water quality standard for total Hg is 0.77 µg/L in freshwater and 0.94 µg/L in saltwater. Field parameters (pH, temperature, DO and conductivity) were also sampled. The average total Hg in the 11 stations in the Chickahominy River watershed was 2.15 ng/L. The highest Hg level at 3.92 ng/L was in Upham Brook, an urban stream in Henrico County. The lowest Hg level at 1.07 ng/L was in Jones Run in New Kent County.

The Virginia Department of Health (VDH) issued a Fish Consumption Advisory for 72 miles of the Pamunkey River from Nelson Bridge Rd. (Rt. 615) to the York River at West Point on 9/30/2004. This advisory was established after unacceptable levels of Hg in fish tissue of Blue Catfish were detected. This one year study was designed to begin gathering data to determine the spatial extent of this problem in the watershed and to observe patterns of relative contamination throughout the watershed. Monthly monitoring of trace total mercury in water was performed in 2012 at 9 stations. The chronic water quality standard for total mercury is 0.77 µg/L in freshwater and 0.94 µg/L in saltwater. Field parameters (pH, temperature, DO and conductivity) were also sampled. The average total Hg in the 9 stations in the Pamunkey River watershed was 1.95 ng/L. The highest Hg level at 2.72 ng/L was in North Anna River in Hanover County. The lowest Hg level at 0.96 ng/L was in Cohoke Mill Creek in King William County. Stations in Little River and the North Anna River are being re-sampled in 2014 because of single unusually high values during the summer at each station.

The Virginia Department of Health (VDH) issued a Fish Consumption Advisory for 55 miles of the Mattaponi River from Route 628 to the York River at West Point on 12/13/2004. This advisory was established after unacceptable levels of mercury in fish tissue in Largemouth Bass were documented. This one year study was designed to begin gathering data to determine the spatial extent of this problem in the watershed and to observe patterns of relative contamination throughout the watershed. Monthly monitoring of trace total mercury in water was performed in 2012 at 7 stations. The chronic water quality standard for total mercury is 0.77 µg/L in freshwater and 0.94 µg/L in saltwater. Field parameters (pH, temperature, DO and conductivity) were also sampled. The average total Hg in the 7 stations in the Mattaponi River watershed was 1.93 ng/L, almost identical to the Pamunkey River. The highest Hg level at 2.49 ng/L was in Tastine Swamp in King and Queen County. The lowest Hg level at 1.30 ng/L was in Walkerton Creek in King and Queen County.

The Virginia Department of Health (VDH) issued a Fish Consumption Advisory for Piscataway Creek and Chandlers Mill Pond, tributaries to the Rappahannock River on 8/13/2007. The Piscataway Creek advisory has been removed. This advisory was established after unacceptable levels of mercury in fish tissue of Largemouth Bass, Black Crappie and Bowfin were detected. This one year study was designed to begin gathering data to determine the spatial extent of this problem in the watershed and to observe patterns of relative contamination throughout the watershed. Monthly monitoring of trace total mercury in water was performed in 2012 at 8 stations. The chronic water quality standard for total mercury is 0.77 µg/L in freshwater and 0.94 µg/L in saltwater. Field parameters (pH, temperature, DO and conductivity) were also sampled. The average total Hg in the 8 stations in the Rappahannock River watershed was 1.99 ng/L, very close to the Pamunkey and Mattaponi Rivers. The highest Hg level at 2.89 ng/L was in Occupacia Creek in Essex County. The lowest Hg level at 1.58 ng/L was in Mount Landing Creek in Essex County.

PRO continues to sample trace total Hg in the Meherrin, Nottoway, Blackwater, James, Chickahominy and Pamunkey River watersheds through 2014 in preparation for possible future watershed Hg TMDLs.

E.coli in Standing Water on Recent Biosolids Applications Study, 2010 - 2012

DEQ staff has received questions from citizens, municipalities, environmental groups and others about fecal coliform bacteria levels in biosolids that are applied to agricultural fields and forests. Until now the only answer that staff could give is that Class B biosolids are required to have less than 2 million MPN (colonies) per gram. The state laboratory (DCLS) does not have an approved method to measure the amount of bacteria in biosolids, so DEQ had no way to scientifically respond to this question. The

purpose of this study was to gather information about the potential of bacteria to run off from biosolids application sites, which is actually a more valuable piece of information than how much is contained in the biosolids.

Water quality monitoring was conducted at 45 stations on farm fields and forests in the Piedmont and Coastal Plain regions of PRO from February 2010 – June 2012. DEQ staff collected E. coli water quality samples from standing water on farm fields and in forests following storm events of sufficient rainfall where biosolids were applied within the previous 8 days. Almost all sample stations were in agricultural fields. Sampling discreet standing water pools minimized the chance of contamination by avian or wild/domesticated mammalian waste by limiting the drainage area for each sample. Attempts were made to sample applications of both lime stabilized and digested biosolids. E.coli results at 92 percent (23 of 25) of fields applied with lime stabilized biosolids were at or below the minimum level of detection (100 cfu/100 mL). E.coli results at 90 percent (18 of 20) of fields applied with digested biosolids were above the water quality standard (235 cfu/100 mL). E.coli results at 50 percent (10 of 20) of the fields with digested biosolids were at or above the maximum level of detection (8000 cfu/100 mL).

PCBs in Runoff from Fields Applied with Biosolids Study

DEQ initiated a study to investigate whether agricultural fields that receive applications of biosolids are potential sources of PCBs for waters that are impaired of the Fish Consumption Use due to PCB advisories. The study is designed to estimate PCB concentrations from field stormwater runoff. It is hypothesized that if PCBs were to be detected in the runoff from these sites, the PCB loading would diminish over time. Agricultural fields permitted to receive biosolids were selected from areas within the James River (3 sites tidal/ 1 site non-tidal), Rappahannock River (2 sites), Mattaponi and Pamunkey Rivers (1 site each), and Meherrin River basins (1 site). To account for variability associated with municipal sources of biosolids, different suppliers are considered within the site selection process. Two sites will also be selected to determine background PCB concentrations (i.e., fields which have never received a biosolids application). The multi-watershed PCB study comprises a total of 35 PCB samples, with 23 consisting of stormwater runoff water samples and 10 biosolids samples collected either directly from the field or from the biosolids source pad. Study results are pending.

James River and Gillie Creek E. coli Geometric Mean Water Quality Standard Study

Gillie Creek and the tidal James River are among the waterbodies impaired for the primary contact recreation use due to E. coli bacteria. The TMDL has been developed and has been approved by the EPA and Implementation Planning is complete. Both Gillie Creek and the tidal James River receive Combined Sewer Overflows (CSOs) during and immediately following rainfall events. The City of Richmond has made excellent progress for the last 20 years in reducing the bacteria loads from CSO events by implementing improvements outlined in the CSO Long Term Control Plan (LTCP). The City of Richmond began weekly sampling at a number of sites on the tidal James River from the fall line to the mouth of the Appomattox River in 2010. Their purpose was to evaluate E. coli in this segment by the geometric mean water quality standard (WQS) of 126 cfu/100mL rather than by the instantaneous standard. The E.coli geometric mean WQS requires 4 or more samples per calendar month, taken approximately weekly, to assess impairment.

As resources allowed, the DEQ sampled weekly at nine stations interspersed between the City of Richmond stations, including a station immediately below the mouth of Gillie Creek and one station in Gillie Creek. The goal of this study was to collect E. coli weekly which allowed the segment to be assessed using the geometric mean water quality standard. Samples were collected on the same date each week to preclude non-random sampling for storm events. E. coli was sampled on as many weekly events as possible from October 2010 to December 2011. After combining the City of Richmond and DEQ stations the tidal segment from the Fall Line downstream to Hopewell, VA was assessed by the geometric mean WQS. The E. coli geometric mean WQS violations in the tidal James River were concentrated near the mouths of Gillie Creek (3), Falling Creek (2), the Appomattox River (3) and Bailey Bay (5) in Hopewell.

TIDEWATER REGIONAL OFFICE (TRO)

Low level PCB sampling in the Elizabeth River

The Elizabeth River and its tributaries have VDH fish consumption advisories for PCBs, and thus are impaired for PCBs. Ambient water samples were collected from locations throughout the watershed during spring and early summer 2009 and spring 2010. Samples were collected during “dry” weather and “wet” weather conditions. Monthly sampling at a single station in the mainstem of the river began in April 2011 and continued for one year. Additional “dry” and “wet” weather sampling was again conducted in spring 2013. A low level analytical procedure using high resolution GC/ mass spectrometry capable of part per quadrillion detection levels was used to analyze the samples. The results will be used to support development of a TMDL for the watershed.

Harmful Algal Blooms/Pfiesteria Monitoring

The Department of Environmental Quality and the Department of Health, including the Division of Shellfish Sanitation, work together to respond to potentially harmful algal blooms (HABs, including Pfiesteria). Samples from algal blooms and fish kill sites are sent to Old Dominion University and the Virginia Institute of Marine Science for a detailed evaluation for potential harmful algae species. Additional information can be found at: <http://www.vdh.virginia.gov/Epidemiology/DEE/Waterborne/HABS/>

Coastal 2000 Initiative

The Tidewater Regional Office has been involved with the Coastal 2000 Program as part of the EPA National Coastal Assessments Program. Data has been collected during summer months from 2001 through 2013 at randomly selected sites. For additional information contact the project manager, Dr. Don Smith at donald.smith@deq.virginia.gov.